2018 / 2019

4 (a) A 10 L cylinder contains 4 g of hydrogen gas and 28 g of nitrogen gas. If the temperature is 31 ^{o}C,

(i) Determine the total pressure of the gaseous mixture.
(ii) Calculate the partial pressure of hydrogen gas.
(iii) What will happen if the gaseous mixture is heated to 550 ^{o}C?

[7 marks]

(b) Under the same condition of temperature and density, determine which gas behaves ideally: CH_4 or SO_2.

[3 marks]

(c) In an experiment when gelatine was added to water, the water became viscous. Explain the relationship between viscosity and intermolecular forces.

[2 marks]

2019 / 2020

4 (a) When coal is burnt, the sulphur present in coal is converted to sulphur dioxide which is responsible for the acid rain phenomenon.

$$S\,(s) + O_2\,(g) \rightarrow SO_2\,(g)$$

If 2.54 kg of sulphur is reacted with oxygen, determine the volume of sulphur dioxide gas formed at 30.5^{o}C and 851.2 mmHg. [5 marks]

(b) In an experiment, NH_3 gas was produced and collected using water displacement method. At 24^{o}C and atmospheric pressure of 762 mmHg, the volume of the gas collected was 128 mL. Calculate the mass of the gas obtained.
[Given the vapour pressure of water = 22.4 mmHg] [6 marks]

2020/2021

4 (a) Sketch a labelled phase diagram of carbon dioxide. [4 marks]

(b) 2.0 g of He and 61 g of O_2 were placed in a 5.0-L tank at 25 ^{o}C. Determine the partial pressure and the total pressure of the gas mixture.

[5 marks]

2021 / 2022

20. **FIGURE 2** shows two connecting vessels containing Gas X and Gas Y at room condition. The gases are allowed to mix when the valve in between is opened. Calculate the total pressure for the mixture of gases. Assume that there are no changes of the temperature.

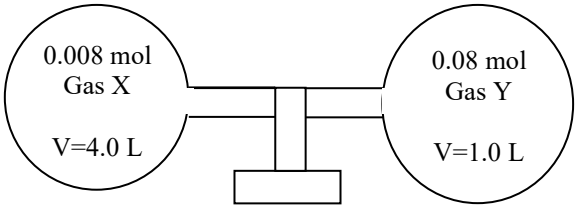


FIGURE 2

21. Determine the volume of 0.323 mol of a gas at 30 ºC and 0.9 atm.

22. Choose the statement that explains why liquid with a lower vapour pressure has a higher boiling point.

A. Vapour pressure of a liquid is proportional to its boiling point.
B. Liquid molecules on the surface require less heat to form the vapour molecules.
C. Liquid molecules can easily escape to the vapour phases which lower the vapour pressure.
D. Liquid with a lower vapour pressure needs more energy to overcome the strong attraction between molecules.

2022 / 2023

4 (a) A sample of zinc metal reacts completely with hydrochloric acid as shown in the equation below:

$$Zn\ (s) + 2HCl\ (aq) \rightarrow ZnCl_2\ (aq) + H_2\ (g)$$

The hydrogen gas produced is collected by water displacement at 25 ºC. The volume of gas is 7.80 L and the pressure is 0.980 atm. Calculate the amount of zinc metal (in grams) consumed in the reaction if the pressure of water at 25ºC is 0.0313 atm.

[4 marks]

(b) Pure water has a triple point at 0.01ºC, 0.006 atm and a critical point at 374 ºC, 218 atm.

i) Sketch a labelled phase diagram of pure water. Draw a line to indicate the boiling point of pure water.

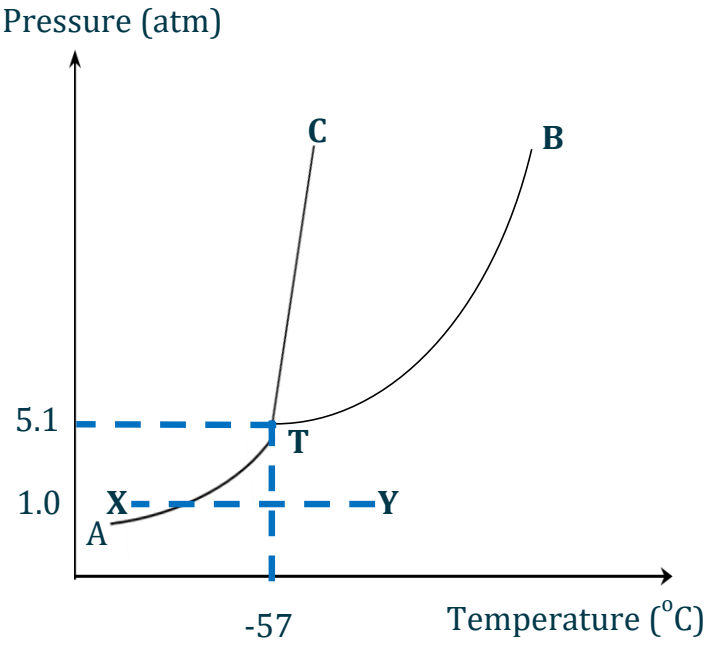
ii) Determine whether water or ice is denser. Explain your answer.

[5 marks]

2023 / 2024

4 (a) A 5.0 L vessel contained neon gas at 25 °C and 2 atm. Hydrogen gas was added to the same vessel resulting in the total number of moles of gases to be 0.51 mol. Calculate the partial pressure of hydrogen gas in the vessel. [5 marks]

(b) The phase diagram for carbon dioxide is shown below.



(i) Explain the process that occurs when moving from point **X** to point **Y**.

(ii) Discuss the effect of pressure along the **TC** line.

(iii) Determine the state of matter above point **B**. [4 marks]

2024 / 2025

4 (a) Potassium chlorate, $KClO_3$ decomposes upon heating as below:

$$2KClO_3\,(s) \rightarrow 2KCl\,(s) + 3O_2(g)$$

When a sample of $KClO_3$ is heated, 240 mL of oxygen gas with pressure 755 torr is collected over water at 26 °C. Calculate the mass of the decomposed $KClO_3$.
[Pressure of water vapor at 26 °C is 25 torr] [5 marks]

(b) Pentane, C_5H_{12} is a liquid whereas methane, CH_4 is a gas at room temperature. Explain the difference in physical state of both hydrocarbons based on intermolecular forces. [4 marks]